5. PROMOTING STUDENT INTEREST IN TECHNOLOGY

The Problem

Many young Americans are ignorant about technology and careers requiring knowledge of it. Furthermore, many students and their parents associate technically oriented courses with traditional vocational programs and hold them in low esteem. As a result, schools face a challenge: how to engage students in exploration of technology and enhance the status of technical education as a career preparation path.

The Strategy: Technology Education Laboratories

Laboratories outfitted with workstations at which students can carry out technology projects independently were observed in several Tech-Prep consortia. Such labs, which are widely implemented elsewhere in middle schools and high schools, can give students hands-on experience working with electricity, electronics, biotechnology, film animation, TV and radio broadcasting, lasers and fiber optics, computer-assisted design, and potentially many other fields. Students typically work in pairs, following instruction manuals and writing up reports, with teachers serving as resources and coaches.

Advantages and Benefits

As part of Tech-Prep or a more comprehensive School-to-Work system, technology labs can:

- ***Introduce Students to a Wide Range of Technical Fields.*** Students can explore everything from plumbing and electricity to lasers and robotics and can overcome preconceptions about the kinds of careers technical education leads to. Female students can potentially discover interests in traditionally male-dominated occupations.

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- ***Promote Independent Inquiry.*** Well-structured laboratory projects can stimulate students' curiosity and help them experience the rewards of exploring something new on their own.

- ***Encourage Self-Assessment.*** Self-guided projects, in which students review the quality and thoroughness of their own work, provide suitable opportunities for students to assess how well they have done and to identify ways in which they can improve.

- ***Sharpen Basic Skills and Develop Teamwork Skills.*** Following technical manuals and writing project reports give students practical exercises with a relevant substantive focus. Working together with other students requires mutual support and openness to criticism.

Implementation Challenges

A sophisticated technology laboratory is a complex undertaking. Schools will need to invest heavily in prepackaged laboratory setups, or muster staff creativity and energy to design and construct their own lab stations. To ensure that a wide range of students benefit, schools must at first convince parents that the labs are not "just vocational classes." Teachers must coach rather than instruct--for some, a new role.

PROMOTING STUDENT INTEREST IN TECHNOLOGY

Attracting students to Tech-Prep often requires overcoming ingrained and widespread attitudes about educational options and the careers to which they can lead. Students and their parents, according to local Tech-Prep coordinators, sometimes equate Tech-Prep with traditional vocational education. In many districts, vocational education was limited for decades to traditional crafts and trades that may now offer limited prospects for employment or decent, reliable incomes. Outdated vocational programs typically served the least academically talented students and were held in low esteem by college-bound students. Female students, in particular, may still be inclined to view the more technical branches of vocational education, and by extension Tech-Prep, as leading only to blue-collar jobs and unpleasant working conditions, and thus as a male domain. Yet, a foundation in the fundamentals of technology can win students access to some of the best-paying career opportunities. Students who fail to develop this foundation can be excluded from these fields at the entry level. Furthermore, many will never even consider technical careers as they form their aspirations for higher education.

Negative perceptions of technical careers and the sophistication, variety, and standards found in technical education can be self-fulfilling if not countered. Unless a wide spectrum of students is exposed to the excitement and challenge of working with modern technology, there is a risk that secondary technical programs will attract only students who see high school as the end of their education, or who seek courses they hope will have low academic content and demands. Failing to attract the interest of a wider range of students may not only limit overall demand for technical programs, but also make it difficult to expand these programs into modern technologies that require strong math and science knowledge and lead to postsecondary education or training. A common challenge, therefore, is how to provide engaging, stimulating, and demanding exposure to technology in a public school curriculum for all students.

TECHNOLOGY EDUCATION LABORATORIES

In several Tech-Prep consortia included in this study, technology education laboratories have been installed as part of broader strategies to overcome ignorance of technology and low regard for technical careers and education. In the Tantasqua School District in western Massachusetts (a member of the Tech-Prep West Consortium), a technology laboratory has been installed in the comprehensive high school as the basis for a full-year ninth-grade elective course. In the Alachua County Schools, part of the Santa Fe Community College Consortium centered in Gainesville, Florida, technology laboratories have been installed in each of the district's middle schools for use in an eighth-grade elective course. The Dothan, Alabama, schools have implemented a technology lab in their Carver Middle School, and the Fresno district in its Hoover High School.

The most elaborate use of technology labs was found in the Tantasqua district. Called the Tantasqua Technology Center, the lab is the base of operations for TECH I, a year-long course of hands-on projects organized around six career areas: health sciences, construction, communications, business management, manufacturing, and energy/transportation. TECH I is a required course for ninth-grade students who have already decided to pursue a vocational program, and an elective for other students, many of whom might be planning to attend four-year colleges. Students attend the laboratory for a double period every other day; they spend the same double period in a physical science class on the alternating days. The center has 42 modules or stations (see Attachment 5.1). Some were purchased from a commercial vendor; others were designed and developed by school staff, as a way to keep costs down and to extend the range of technology exercises to include some for which no modules were available commercially.[1] The titles of the lab modules suggest the wide range of exploratory projects students can undertake.

[1]For example, school staff built a small room in the lab that allows students to do exercises in carpentry framing, electrical wiring, plumbing, and interior design.

Students are expected to choose modules that interest them, but also to complete a specified number of modules each marking period.[2] Completion of each module earns students points; the points earned vary depending on the complexity and estimated amount of time required.

The technology lab modules at Tantasqua are designed to promote development of communications skills as well as familiarity with technology. Some modules require that students not only perform the required experiment or technical exercise, but also carry out a task intended to strengthen their writing or speaking skills. In some modules, for example, they can choose to do a research paper on careers related to the technology module, make an oral presentation about the technology, construct a learning aid or make a lab improvement, or prepare a poster designed to communicate information about a related career (see Attachment 5.2 for a menu of communications exercises). Other assignments, not related to completion of specific modules, contribute to development of communications skills and career exposure. Each student, for example, is required during the semester to conduct an interview with an employer in the community, preferably in a technology field, and to prepare a paper about careers in that field.

Students' grades in the Tantasqua TECH I course reflect several dimensions of their work. The students maintain a portfolio of their products of work. Their grade for the course is determined by the quantity and quality of work they complete on lab modules, their communications exercises, and their portfolios.

The two middle schools using technology labs, in Gainesville and Dothan, incorporate a somewhat narrower range of technology--generally about 12 to 15 workstations. At an aerodynamics station in the Gainesville lab, students shape wings from styrofoam, mount them in a wind tunnel, measure the resulting lift, and write a comparison of the performance of the different designs. At another station, students build miniature cars equipped with magnets to induce levitation and reduce friction, and test the effects of

[2]In other technology labs with fewer stations, students are often required to work their way through all of the available modules.

levitation on their speed down an inclined plane. At each station, students work in pairs, following a procedures manual. At the completion of the project, they write a report on their findings.

ADVANTAGES AND BENEFITS OF TECHNOLOGY LABORATORIES

The technology laboratories in the Tantasqua, Gainesville, and Dothan districts demonstrate five important contributions to Tech-Prep, discussed next.

1. ***Enhancing the Status of Technology and Technical Education.*** Opening technology labs to all students, and exposing students with a wide range of interests and abilities to the excitement of hands-on learning, can change perceptions of technical programs. In just a few years in the Tantasqua district, students have told other students and their parents about their positive experiences in the labs, and the number of high school freshmen exposed to the school's technical division has doubled. The number of academic students taking elective courses in the technical division has also doubled. The labs have also substantially increased the participation of ninth-grade females in the technical division, which may in the longer term lead to an increase in female participation in technical course sequences in later grades.

2. ***Promoting Integration of Academic and Vocational Classes.*** As structured in Tantasqua, technology labs can promote curriculum integration. By having students attend double-period technology lab and physical science classes on alternating days, the district has created opportunities for cooperation between science and technology instructors, who now collaborate on the design and development of lab modules and ways to incorporate technological applications into science discussions. Communications exercises integrate English skills in technical writing into the technology-focused curriculum, and English teachers participate in developing and grading these exercises.

3. ***Strengthening Basic Skills.*** Students must work from written procedure manuals to complete their projects and must write reports. Their tasks simulate the way they will have to apply basic skills in the workplace--following instructions, translating instructions into action, organizing information, and writing and speaking about what they have done. Making students' grades depend in part on their written work underscores the point that technical education is not simply aimed at developing manual skills.

4. ***Building Teamwork Abilities.*** In the labs we observed, students work in pairs to complete their projects. They must define their respective roles, share in all aspects of the projects, and help each other when they run into trouble. Since students of different interests and abilities enroll in the labs, students may lead in some tasks and allow a partner to lead in others.

5. ***Promoting Self-Assessment.*** Technology labs can help students develop habits of independent inquiry and can also encourage them to take responsibility for the quality of their work and to assess how well they have performed. In the Tantasqua TECH I course, for example, students are asked to propose their own grade for each marking period and defend their recommendation in a presentation to the faculty. Faculty members report that students are generally quite aware of the ways in which

their performance can be improved. By being involved in their own assessment, the students are more likely to internalize grades as indicators of how they can improve than if a grade were simply handed to them.

The excitement and satisfaction students can draw from technology education laboratories implemented with a clear sense of purpose and curricular structure are illustrated by the comments of a few students who completed the TECH I course at Tantasqua, as collected by school staff in a program evaluation survey:

> Finally, a program that really cares about a decision that will affect you for the rest of your life. The TECH program is the missing link to my career.
>
> It's an unbelievable and unreal experience. The modules help you understand today's technology. The instructors help you go about doing the activities required. They are always there for you. You are treated with respect and inspired by the things you've accomplished.
>
> Even if you know what you want to be when you're older, you still find hidden interests within yourself going into the technology program.

IMPLEMENTATION CHALLENGES AND ISSUES

Technology labs face four major challenges or choices:

1. ***Finding the Capital Resources***. Successful technology laboratories require a substantial expenditure of money and time. Administrators in Gainesville estimate that setting up their technology laboratories cost between $80,000 and $100,000 for each middle school. In the Tantasqua district, where many lab modules were built by teachers, the 42-station laboratory cost $88,000, including refurbishment of the lab space, materials, and purchased equipment for some stations. Dothan administrators estimate that its 13-module lab cost almost $48,000 to create.

   Some districts have created mobile technology labs in large tractor trailer vans. Such labs, although they also involve substantial investment, can be moved from school to school, thus reducing the cost per school. Hands-on technology exercises can then be integrated into existing science or career exploration courses.

2. ***Overcoming Stigma of Vocational Classes***. Technology labs have won enthusiastic support in the districts observed, but some initial reservations may be encountered, particularly on the part of parents. In Gainesville, for example, the technology laboratory course was labeled as a vocational course (largely because it was developed with vocational education funds). In its first year of operation, school counselors encouraged students to sign up for the elective course, including many whose parents then objected to their children being placed in a "vocational class." After parents visited the lab, however, they became enthusiastic supporters; by the second year,

there were waiting lists for the class. Careful communication with parents about technology labs and their benefits can defuse negative concerns and possibly reduce the time required to build support.

3. ***Developing Coaching Styles of Instruction.*** Technology labs clearly demand a teaching style that is unfamiliar to some teachers. Fortunately, the districts we observed placed responsibility for the labs in the hands of experienced vocational instructors, who are often more attuned than academic teachers to helping students work independently on projects. Giving academic teachers a chance to work together with vocational instructors, while focusing on the conceptual underpinnings of hands-on exercises, appears to promote hands-on learning in the labs as well as in the related academic classes. However, it is important either to choose instructors who can help students see the connections between the tasks they are working on and underlying science and math concepts, or to provide the necessary staff development required for teachers to be effective in the labs.

4. ***Targeting Lab Courses: When and for Whom?*** Choosing how to integrate technology labs into a district's overall program can affect how fully their potential benefits are realized. Some districts, for example, have chosen to offer technology labs as the basis for an exploratory program in vocational high schools--an arrangement that is unlikely to serve the objective of exposing a broad range of more academically inclined students to hands-on learning about technology. Labs offered as elective courses in middle schools are more likely to engage the interest of a wide range of students and may serve as a critical part of a comprehensive school-to-work system. If labs are used in comprehensive high schools and are open to all ninth-grade students, vocational programs that traditionally placed their students in a particular occupational course as freshmen must revise their approach and treat the ninth-grade lab as an exploratory course that leads to a later choice of specialization.

ATTACHMENTS:

5.1 TANTASQUA REGIONAL HIGH SCHOOL TECHNOLOGY CENTER: MODULE DESCRIPTION 1995-1996

5.2 "SUCCESS STARTS HERE": TANTASQUA TECHNOLOGY CENTER COMMUNICATION SKILLS DEVELOPMENT MENU AND DAILY JOURNALS